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Short Review of the Non-Purging Option for Hydrocarbon Monitoring Wells

Most of today's well purging methods were developed during studies of water supply wells in the 1960's and early 1970's (Powell and Puls, 1997). The studied wells were usually steel cased with screens set below the top of the water table, and they were analyzed for inorganic water quality parameters.

The procedures used for sampling the water supply wells called for removing about three well volumes of water before sampling, because all the water in a well was thought to be "stagnant", and not representative of water in the aquifer. This purging or removal of the "stagnant" water was deemed necessary before taking "fresh" samples. These procedures have since been carried over into the sampling of groundwater monitoring wells.

Traditional purging methods do present problems such as:

- excessive agitation resulting in volatilization and degassing which gives erroneous results;
- if the well is purged dry (common in Indiana's low permeable areas) the recharge water cascading through the sand filter pack can lose up to 70% of volatile organic compounds (McAlary and Barker, 1987);
- preferential recharge from more porous layers, biasing the sample;
- increased turbidity from the disruption of the sand pack and surrounding soils;
- the large amount of time and effort, resulting in increased labor expense; and
- disposal of large volumes of contaminated, purged water at considerable handling expense, and some risk of additional spills.

Recent studies to determine actual well flow patterns, including direct observation of colloidal suspensions and dyes in wells, have changed previously held dogma (Kearl, Korte and Cronk, 1992; Powell and Puls, 1993). Multiple studies have shown that while the water above and below a well screen may be stagnant, the water actually in the screened section flows across the well with no significant mixing of water in the screened interval with the stagnant water above or below. This holds true even for wells completed in low permeable materials (Robin and Gillham, 1987).

This shows that a sample taken from the screened area only (excluding stagnant layers above and below the screen) should be of "fresh" water, representative of the aquifer. Purging, with its attendant problems, could be avoided. Most normally constructed wells do not have much

additional casing below the screen, and if present it could be avoided by restricting the depth of the sampling device. Stagnant water in the casing above the well screen is much more difficult to avoid. It should not be a factor in properly constructed wells measuring hydrocarbon contamination, because the screen is required to extend above the water table.

Recent papers have reported on the feasibility of not purging at all in sampling wells used for hydrocarbon monitoring. A large study sponsored by the Western States Petroleum Association (1996) used 13 different contractors to take 556 paired (non-purged and purged) samples from 101 sites. Overall, the non-purged samples averaged 9.5% higher BETX results than purged samples. Most of the variation was found in samples taken using bailers or vacuum trucks to purge the wells, and from a few wells in coarse lithology. When these wells were removed from the data set, there was no difference in purged and non-purged samples at a 90% confidence level.

Another study by the California Regional Water Quality Control Board (Williams, et al, 1996) took 164 paired samples at 69 sites. Mean values for all BETX components were slightly higher for non-purged samples than for purged ones. The cost for non-purging was 50% less than the purged sampling.

A similar study in New York by Shell (Byrnes, et al, 1996) utilized 168 paired samples from 13 sites, and found no significant difference at a 99% confidence level. No difference was found between samples from fine and coarse grained sediments.

Recent tests by Shell in Indiana analyzed 29 paired samples from 12 locations. No significant variations were found, except for two wells, both which would be invalid for a non-purge sampling. One well had the screen below the water table, and the other contained free product.

These studies, and others like them, have demonstrated that purging is not necessary under specific conditions when sampling hydrocarbon monitoring wells. Data are reliable, much time and money is saved, and waste handling and disposal problems of purged water are dramatically reduced.

The state of California now allows non-purging for hydrocarbon monitoring wells. The California EPA has issued a guidance document (California EPA, 1997) detailing procedures, conditions, and exceptions. Such an approach would have immense benefits to Indiana. Besides the money and time saved, much of this state is covered with low permeable soils, in which purging is difficult or impossible without running the wells dry, thus costing more time waiting for recharge and possibly biasing samples.

Bibliography

Byrnes, J. P., Brigalia, J. E., and Bealer, L. J. 1996. Evaluation of well purging in ground water sampling for BETX and MTBE. Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water Conference, National Ground Water Association, Westville, OH, pp. 221-235.

California EPA 1997. Utilization of non-purge approval for sampling of monitoring wells imported by petroleum hydrocarbon, BETX, and MTBE. Guidance document, Jan. 31, 3 p.

Kearl, p.m., Korte, N. E. and Cronk, T. A. 1992. Suggested modification to ground water sampling procedures based on observations from colloidal borescope. *Ground Water Monitoring Review* 12, no. 2, pp 155-161.

McAlary, T. A. and Barker, J. F. 1987. Volatilization losses of organics during ground water sampling from low-permeability materials. *Ground Water Monitoring Review* 7, no. 4, pp. 63-68.

Powell, R. M. and Puls, R. W. 1997. Hitting the bulls-eye in groundwater sampling. *Pollution Engineering*, June, pp. 50-54.

Powell, R. M., and Puls, R. W. 1993. Passive sampling of groundwater monitoring wells without purging: Multilevel well chemistry and tracer disappearance. *Journal of Contaminant Hydrology*, vol. 12, pp. 51-77.

Robin, M. J. L. and Gilham, R. W. 1987. Field Evaluation of well purging procedures. *Ground Water Monitoring Review.* Vol. 7, no. 4, pp. 85-93.

Schoedel, L. 1997. Purge/no purge study conducted at Shell service stations. Report/letter to Steve Poe, April 21, 8 p.

Western States Petroleum Association, 1996 Final report: The California groundwater purging study for petroleum hydrocarbons. October 28, 92 p.

Williams, K., Martinez, A., Daugherty, S., and Lundegard, P.D., 1996. Groundwater sampling - a pilot study of the effects of well purging. Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water Conference, National Ground Water Association, Westville, OH, pp. 191-206.